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FORMER COURSES OF THE ANDROSCOGGIN RIVER

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INTRODUCTION

The Androscoggin River is one of the most interesting of the many examples of disarranged drainage in New England and merits more attention than it has hitherto received.

The present study has involved a critical examination of the topographic relations of the Androscoggin and several adjacent rivers, differentiating the topography controlled by underlying bed-rock formations from the topography of surficial deposits.

Nearly all that part of the problem south and east of Berlin, New Hampshire, is covered by the topographic sheets of the United States Geological Survey; but the region north of Berlin is best shown on Hitchcock's map of New Hampshire;[2] and, finally, the hydrography of the entire area included in this investigation is shown in outline on the accompanying drainage map (Fig. 1).

TOPOGRAPHY

The drainage basin of the Androscoggin River, approximately 125 miles long in a northwest-southeast direction and 30 to 40 miles in normal breadth, may be divided into five topographic provinces, as follows: headwater, upper, middle, lower, and coastal; and in each province the river has characteristics peculiar to that province.

The Androscoggin River is formed by the junction of the Magalloway River and the drainage of the Rangeley Lakes, near Errol, New Hampshire. The headwater province extends north and east from this point to the ultimate sources of the river and will not be further considered in this paper.

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[1] The writer wishes especially to express his indebtedness to President W. W. Atwood, under whose direction this work was done.

[2] C. H. Hitchcock, atlas accompanying the *Report on the Geology of New Hampshire*. New York, 1878.

The upper province includes the region between Errol and Berlin. It is bounded on the southeast by the Mahoosuc Range,[1] the northeastern extension of the White Mountains, and is characterized by broad valleys and mountains of moderate elevation. Slaty

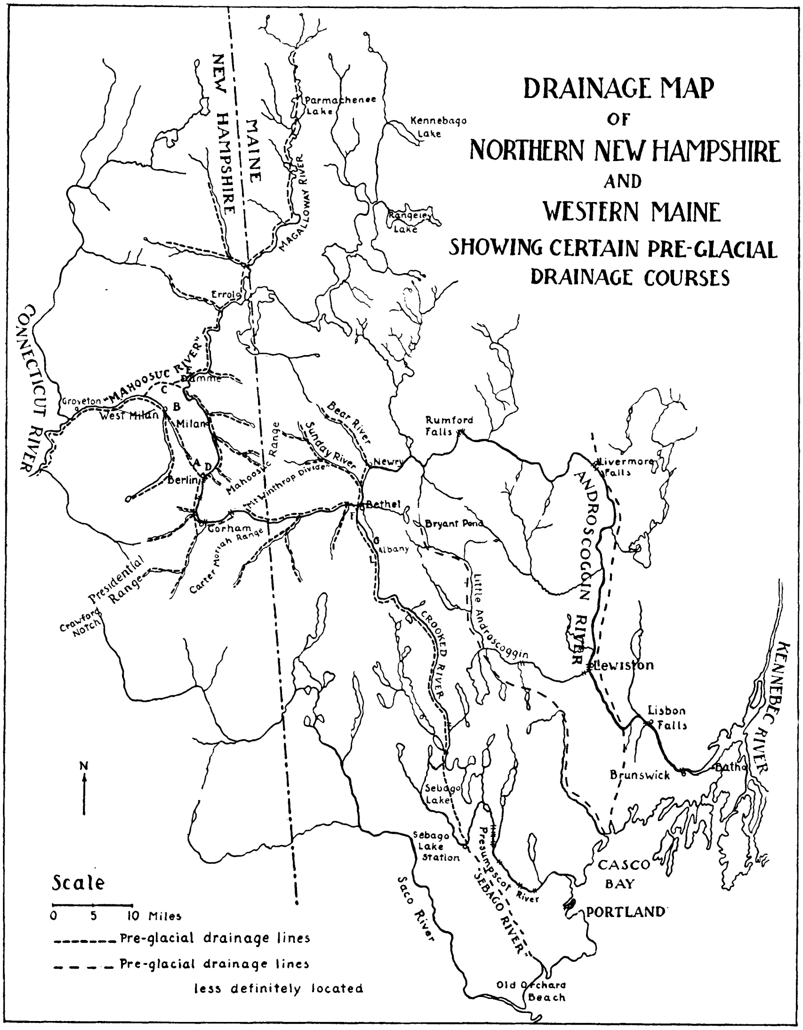

FIG. 1.—Drainage Map

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[1] The range, extending from Gorham, New Hampshire, to Grafton Notch, Maine, and including the following mountains: Baldcap (3,100), Ingalls (3,570), Goose Eye (3,854), and Speckled (4,250), has recently been named the Mahoosuc Range.

rocks prevail in the northern part and granitic rocks in the southern part. The country is heavily mantled with glacial drift; but the existing bed-rock contours indicate that the preglacial topography was in the mature stage of dissection. The river flows southerly through this province, in a broad valley, descending 180 feet in 30 miles, or 6 feet to the mile.

The middle province extends from Berlin, New Hampshire, on the west side of the main ranges of the White Mountains, to Bethel, Maine, on the east side, its high mountains and deep valleys contrasting strongly with the lower mountains and broad valleys of the upper province. The Androscoggin flows southerly from Berlin to Gorham through a narrow valley in granitic rocks, and then turns abruptly to the east and passes, in a deep valley, through high mountains of massive siliceous schists. These schists, the most resistant rocks of the region, form the main ranges of the White Mountains, and extend northeasterly into Maine.

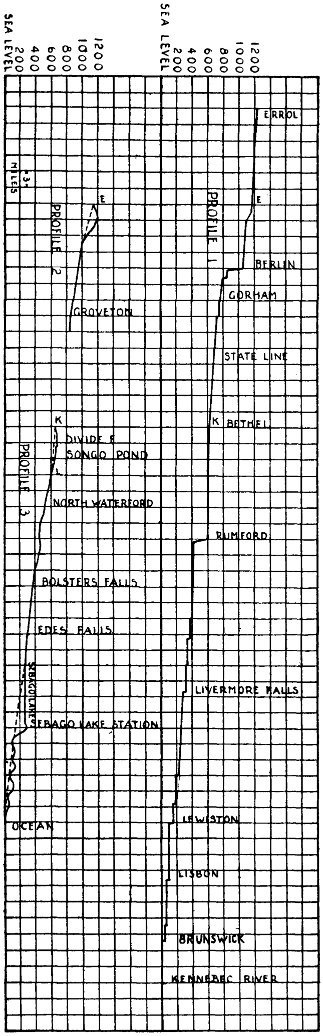

FIG. 2.—Profiles of the present and former courses of the Androscoggin Drainage

In the middle province the river descends 420 feet in 30 miles or 14 feet to the mile, thus having a gradient two and one-third times as great as in the upper province. At Berlin the river drops 200 feet in several falls; and there are a number of other falls and rapids in the first ten miles below that city. Profile 1 (Fig. 2) shows the distribution of fall on the river and emphasizes the contrast of the river gradients above and below Berlin.

Comparison of the middle and upper provinces shows that in the former the valley is younger and deeper, suggesting a great change in the history of the river. These facts, together with the peculiar behavior of the river at the great bend near Gorham, where the river turns abruptly from less resistant rocks into high mountains of more resistant rocks, lead to the belief that the upper part of the valley has been occupied much longer by the river and that it formerly had another route to the sea.

The lower province, extending from Bethel to tidewater at Brunswick, is marked by broad valleys, low passes, and low, rounded mountains. As the sea is approached the mountains disappear and the hills are very low, with the exception of a few monadnocks. The preglacial topography of the region near the mountains was in late maturity and near the coast it was in old age.

In the lower province the course of the river differs greatly from its course in the other provinces in being very irregular, with many sharp turns, as can be seen on the drainage map (Fig. 1) or on the topographic sheets. In this province the river descends 635 feet in 98 miles or 6.5 feet per mile; but this descent consists of a number of falls with quiet stretches between. The numerous sharp turns, narrows and falls indicate that the present course of the river is not normal, and lead one to look for a more direct route.

The coastal province extends from the head of tidewater to the open ocean and is characterized by drowned valleys and by islands. In this province, about 8 miles below Brunswick, the Androscoggin joins the Kennebec, with a retrograde course, that is, the direction of the tributary is reversed in relation to the main stream, the apex of the acute angle between the two streams pointing up the main stream. This abnormal junction of the two rivers is good evidence that the Androscoggin is not here flowing in a normal course.

The higher ranges of the White Mountain system have a northeast-southwest trend; but seaward from these ranges the ridges have a north-south or northwest-southeast direction. This general trend of the topography seaward from the mountains is well shown by the numerous north-south elongated lakes, valleys, and ridges, and the absence of similar features with an east-west trend. Therefore the northerly-southerly direction may be considered as normal for a valley in the region between the mountains and the sea; and the few cases of west to east courses are exceptional.

The writer believes that the present route of the Androscoggin through the mountains in the middle province is not the original course of the drainage of the watershed above Gorham, and also that the route of the river below Bethel is entirely postglacial, the present stream occupying parts of several preglacial drainage systems.

The ice sheet crossed this region in a southeasterly direction, widening the valleys and passes, and developing the characteristic U-profile.

In the mountains till is widespread, but well-defined moraines and drumlins are few. The valleys are relatively narrow, the divides are generally high, and streams are principally controlled by the bed-rock topography and not by glacial deposits.

In the lower province, just east of Bethel, the valleys are broader, the divides lower; and the streams are partly controlled by glacial deposits, while nearer the coast moraines and drumlins are common, rock hills are scarce, and stream control is largely by surficial deposits.

FORMER COURSE OF THE UPPER ANDROSCOGGIN

The present divide between the drainage to Long Island Sound and to the Gulf of Maine extends northerly from the Presidential Range between the valleys of the Connecticut and Androscoggin rivers. This divide has several low passes, one between Berlin and Groveton having a summit less than 100 feet above the Androscoggin River or 1,100 feet above sea-level. The mountains forming the divide are composed of granitic rocks and are less high and rugged than the schist mountains of the main ranges. The irregular northerly-southerly trend of the divide, and its broken character, contrast strongly with the Presidential, Carter-Moriah, and Mahoosuc ranges, which have a regular northeast-southwest trend and have only one low place, the valley of the Androscoggin at Gorham.

These facts coupled with the character of the Androscoggin valley near Gorham indicate strongly that formerly the divide was along the Carter-Moriah and Mahoosuc ranges. If this were the case, the upper Androscoggin had another outlet and the only possible alternate course would have been through the valley now occupied by the Upper Ammonoosuc to the valley of the Connecticut at Groveton.

The broad valley of the Upper Ammonoosuc extends eastward from the Connecticut and connects with the valley of the Androscoggin by three broad, low passes.

The most southerly of these passes (*A* on Fig. 3), between Berlin and West Milan, is traversed by the Grand Trunk Railway and its summit is less than 100 feet above the Androscoggin at Berlin. Dead River, a small, sluggish stream, heads in this pass and joins the Upper Ammonoosuc at West Milan. Dead River appears to have been beheaded near Berlin and before that accident it was undoubtedly large enough to make the broad valley which it now occupies.

The next pass to the north (*B* on Fig. 3) lies between West Milan and Dummer. It is broad, with a summit approximately 100 feet above the Androscoggin. No bed rock is visible in the saddle or on its slopes, and it has every appearance of being deeply drift-filled.

The third pass (*C* on Fig. 3) is about three miles farther north, where a broad branch valley connects with the Androscoggin valley by a pass approximately 100 feet above that river. This pass is very broad with gentle slopes, and no bed rock is visible.

The broad valley between Groveton and West Milan is occupied by the Upper Ammonoosuc River. The narrowest part of this valley is 6 miles west of West Milan, but it is probable that a lake a few miles to the north marks the preglacial course of the river.

The valley of the Upper Ammonoosuc was deeply filled by glacial deposits, which have been only partially cleared out by the present stream; and it is obvious that the preglacial valley was much too wide to be accounted for by the erosive action of the present river. The branch valley toward pass *C* is floored with stratified drift. If all this drift were removed from these valleys, there would be a broad valley, ample for a large river, connecting the Androscoggin with the Connecticut.

Northeast of Berlin is a nearly level plain, rising gradually to the southeast and ending abruptly against the Mahoosuc Range.

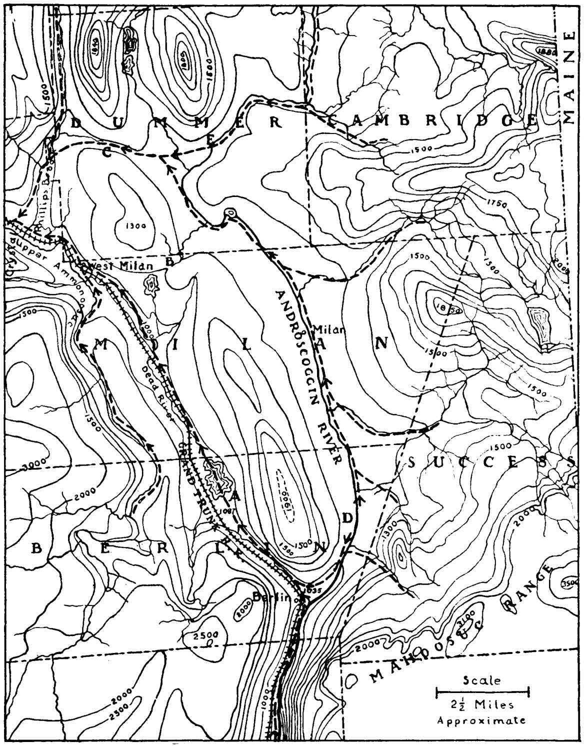

FIG. 3.—Map showing present and former drainage lines about Berlin, Dummer, and Milan, New Hampshire.

----- Former Drainage Lines

Several streams flow northwesterly across this plain and enter the Androscoggin with retrograde courses. The descent from the plain to the Androscoggin at Berlin is abrupt, indicating that the river has been rejuvenated enabling it to lower its bed faster than is possible with the smaller streams.

There are remnants of a bed-rock bench at an elevation of approximately 1,200 feet on the valley sides south of Berlin. At Gorham the elevation of the bench remnants is 1,300 feet (*1* in Fig. 4),[1] and two miles to the east their elevation is 1,400 feet (*2* in Fig. 4). The summit of Mount Winthrop (*3* in Fig. 4), a long spur projecting into the valley five miles east of Gorham, has an elevation of 1,575 feet.

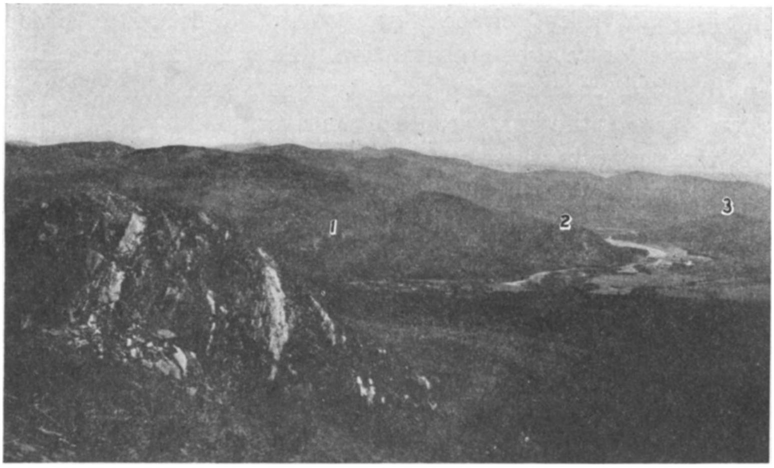

FIG. 4.—View eastward from Pine Mountain, Gorham, New Hampshire

Looking eastward from Mount Winthrop, long, even-crested ridges extend into the valley; and two with elevations of about 1,100 feet appear completely to block the valley. These are evidently remnants of the floor of a valley which descended to the east from a divide where Mount Winthrop now is.

The series of bench remnants rising to the east from Berlin and culminating at Mount Winthrop mark the level of an old valley which extended from the valley now occupied by the Upper Ammonoosuc to a low pass at Mount Winthrop.

Observations from Mount Winthrop give indication of an old land surface descending on either side. On the opposite side of the present valley are benches which correspond to Mount Winthrop and represent the opposite spur of the old divide. There appears to be ample field evidence to prove that eastward from Mount Winthrop Divide the drainage was into the Gulf of Maine, and that westward it flowed to the Connecticut.

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[1] From a photograph by the Shorey Studio, Gorham, New Hampshire.

This divide prevented the Androscoggin from flowing to the east, as it now does, and the broad valley of the Upper Ammonoosuc represents its course when tributary to the Connecticut.

Of the three passes connecting the Upper Ammonoosuc and Androscoggin valleys, either *B* or *C* offers a direct route without sharp angles or reversals of direction. Pass *A* would necessitate a much longer course with a sharp turn at Berlin, and it will not be considered as the former route of the river.

A river appears, therefore, to have flowed through the present Androscoggin valley to Dummer, through pass *C* or *B*, thence down the valley now occupied by the Upper Ammonoosuc, into the Connecticut. The name "Mahoosuc River" is suggested for this stream.

Profile 2 (Fig. 2) shows the grade of this course, the full line representing the present surface and the broken line the probable bed-rock surface; and profile 1 (Fig. 2) shows the grade of the present river. A comparison of these two profiles shows that the former route has a fairly constant grade, a normal condition for a large river, while the present course drops several hundred feet in a series of falls and is characteristic of a younger river which has not yet eroded its valley to grade.

During the existence of the Mahoosuc River a stream from Mount Winthrop Divide joined a stream from Mount Washington and flowed north to the point where Berlin now stands, and then through pass A into the Mahoosuc River. Three miles north of Berlin was a low divide (*D* on Fig. 3) between the drainage to pass A and a stream which joined the Mahoosuc River at Dummer. Between divide *D* and Dummer all tributaries joined the present river with retrograde courses; and at the time when the stream in that valley flowed north instead of south, as at present, these tributaries had normal junctions with the main stream. The old drainage is shown in Figures 1 and 3.

In explanation of the existing drainage it may be stated that the modern valley of the Androscoggin below Berlin represents more erosion than could have occurred since the last ice retreat. Undoubtedly this valley was greatly widened, straightened, and deepened by the movement of ice through it, and possibly the Mount Winthrop Divide may have been removed and the present drainage brought about by ice action. But river piracy also offers a simple explanation.

The stream on the east side of Mount Winthrop Divide had a much steeper grade and thus far greater erosive power. Bethel, 17½ miles east of the divide, has an elevation of 635 feet, and the elevation of West Milan, 23 miles west of the divide, is 1,015 feet. The descent eastward from Mount Winthrop is 57 feet to the mile, while the westward descent is 24 feet to the mile. Allowance for erosion does not materially alter the relations.

From the divide to the Gulf of Maine by the preglacial course of the lower Androscoggin is 90 miles and from the divide to Long Island Sound by the Upper Ammonoosuc and Connecticut rivers is approximately 300 miles. These facts show that favorable conditions for piracy existed.

The Androscoggin River wore its valley back through the low Mount Winthrop Divide, captured the Peabody River, beheaded the Dead River at Berlin, wore through the low divide at *D*, captured several streams from the Mahoosuc Range, finally captured the Mahoosuc River, and thus started the present drainage system.

FORMER COURSE OF THE LOWER ANDROSCOGGIN RIVER

It has been pointed out that the present course of the Androscoggin, in the lower province, between Bethel and the ocean, is abnormal and is of postglacial origin.

For the preglacial course two possible routes are to be considered: eastward along the line of the Grand Trunk Railway or southward via the valley of Crooked River. The latter appears to be the more probable route on account of its lower summit and freedom from obstructions.

The Grand Trunk Railway occupies a pass in the hills near Bryant Pond with a summit elevation of 720 feet above the sea or 85 feet above the Androscoggin at Bethel. From Bryant Pond the Little Androscoggin River flows southeasterly and joins the Androscoggin at Lewiston with a retrograde course. At Snows Falls in the town of Paris the valley is blocked by a rock hill and the stream is crowded into a very narrow gorge. The height of the pass and the obstruction at Snows Falls make it appear that this is not the preglacial course of the Androscoggin. However, glacial outwash material in the valley and pass indicate that in glacial times a large stream flowed this way.

The postglacial origin of the lower part of the Little Androscoggin is shown by its retrograde course and its interruption by two falls. The preglacial course was probably through Poland into Casco Bay.

The present course of Crooked River and the basin of Sebago Lake will now be considered. Crooked River joins the Songo River a little north of Sebago Lake and the joint stream is tributary to that lake. If Crooked River is followed upstream, a surprising discovery is made: its source is only two miles from the Androscoggin near Bethel and the divide separating the two rivers is only 35 feet above the Androscoggin (Fig. 5).

The examination of Crooked River and the basin of Sebago Lake makes it appear that this route was occupied during preglacial times by a large river which flowed southerly from Bethel. This stream was formed in the vicinity of Bethel by the junction of two major streams. One of these headwater streams came from the Mount Winthrop Divide and the other from the north, probably receiving tributaries from the valleys of Sunday and Bear rivers. For convenience this preglacial stream will be referred to as the "Sebago River."

The character of the valley of Crooked River becomes of great importance when considered as a possible course of a large river. The valley is broad and has a direct course with no sharp turns. The name of the stream implies a crooked course, but the windings are all of minor magnitude; they are the meanders of a small stream flowing in a broad valley of low gradient.

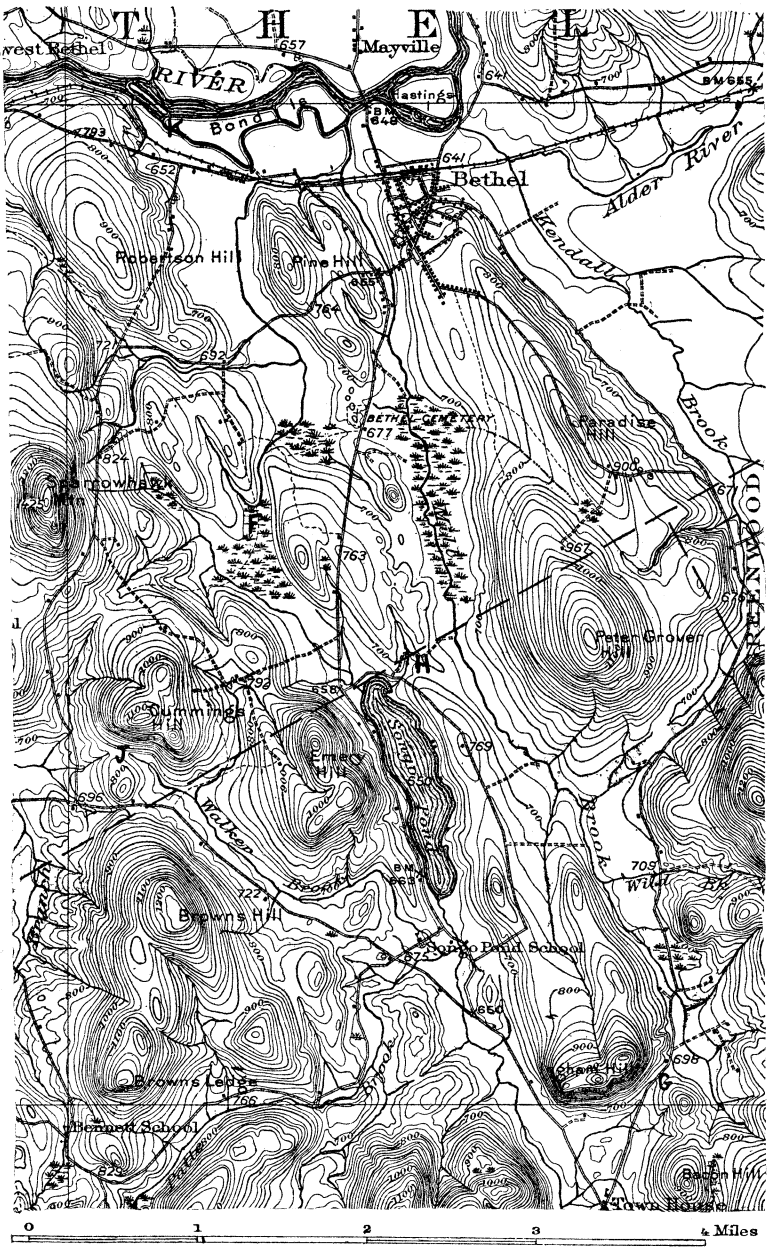

FIG. 5.—Map of the region about Bethel

On the lower course of Crooked River there are several low falls. The valley is filled with drift and in meandering across this drift plain the stream has discovered the ledges that now break its bed. The old river was probably free from falls.

At several places, in its upper part, the valley is rather narrow, but in estimating the size of valley required by the Sebago River it must be remembered that the upper Androscoggin was then tributary to the Connecticut, and the river below Bethel was smaller than the present Androscoggin. It follows that the narrow places which are in the mountains were ample for the Sebago River.

In the town of Albany, at the place marked L on Figure 1, granite bed rock outcrops in the stream at an altitude of 610 feet. The grade of the Sebago River from this point to Bethel was 3 feet per mile or the same as the present grade of the Androscoggin above Bethel.

The entire valley of Crooked River has been carefully studied with regard to narrow places, sharp bends, and elevation of bed rock, and nothing has been found tending to disprove the belief that this was the course of a large river.

There are four passes between the headwaters of Crooked River and the Androscoggin, marked *F*, *G*, *H*, and *J* on Figure 5. The lowest pass (*F* on Fig. 5) is a mile north of the head of Songo Pond. Its summit elevation is 670 feet or only 35 feet above the Androscoggin. The pass is broad, flat, and swampy, and no ledge is visible in the pass or on its slopes; there is nothing to indicate bed rock near the surface, and therefore this pass is believed to be the drift-filled valley of the old river. Songo Pond is reported to be 40 feet deep, which places its bottom 25 feet below the Androscoggin and gives further evidence of a buried valley. The other passes are higher and will therefore not be considered further.

Profile 3 (Fig. 2) shows the grade of the Sebago River from Bethel to the sea. The full line represents the present surface, and where the old river course is now buried, its probable grade is shown by a broken line. A comparison of the profile of the Sebago River with that of the present Androscoggin (Profile 1) shows that the present river has a series of stretches with very gentle gradient broken by falls, while the Sebago River has a constant grade without falls, indicating that the present course of the Androscoggin is partly at least of recent origin and that the course of the Sebago River was for a long time occupied by a large stream.

There is no obstacle today except glacial drift to prevent the Androscoggin from following its old course and a dam 40 feet high at Bethel would enable it to do so.

Sebago Lake is drained by the Presumpscot River, a short stream with seven falls and an indirect course. It is at once seen to be a postglacial stream without a rock valley, and it can be dismissed as a possible course for the Sebago River.

On the south side of Sebago Lake is Sebago Lake Station, where the Main Central Railroad crosses a very low divide. A rise of 20 feet in the lake would cause it to overflow here. The topography is typical of a terminal moraine; kames and kettles are numerous, and there are several kettle ponds.

This morainal dam marks the preglacial outlet of the Sebago Basin and the rock valley which the moraine now fills was undoubtedly the route of Sebago River.

Between Sebago Lake and the ocean the old valley is lost under a heavy mantle of till and extensive marine deposits. There are well-developed marine terraces at several levels near the coast.

The old valley probably reached the present shore in the vicinity of Old Orchard, where there is a broad indentation of the coast with no rock outcrops over a considerable area. Offshore soundings tend to confirm this view.

The valley of Sebago River from Bethel to the ocean has been located and described as fully as conditions permit. It presented, before being clogged with glacial drift, a natural course for a large river and is more probable as the preglacial course of the Androscoggin than the present route.

The Sebago River, which made this valley, had little in common with the present Androscoggin. One branch came from the Mount Winthrop Divide to Bethel, where it joined a branch from the valley of Sunday River.

South from Livermore Falls through Lewiston the present Androscoggin has a fairly direct north-south course in agreement with the general trend of the topography. This region has not been studied in detail, but it appears probable that in preglacial times there was a river following a course similar to that of the present Androscoggin, between Livermore Falls and Lisbon Falls, and emptying into Casco Bay. This preglacial stream with the Little Androscoggin was the principal river between the Sebago and the Kennebec.

The Androscoggin River east of the mountains now occupies parts of two preglacial drainage systems. The main valleys of these two systems were clogged with drift in many places and the resulting drainage follows a circuitous route and empties into the Kennebec with a retrograde course.

CONCLUSIONS

This study has shown that the present course of the Androscoggin River is largely postglacial in origin.

It appears that in preglacial times there was a low divide at Mount Winthrop on the northeastward continuation of the main ranges of the White Mountains. All the drainage northwest of this divide went to the Connecticut River, passing through the valley now occupied by the Upper Ammonoosuc. This drainage system, including the Androscoggin above Dummer and the stream from Mount Winthrop Divide, is here called the "Mahoosuc" system.

Eastward from this old divide a stream flowed to Bethel where it was joined by a branch from the valley of Sunday River; and the stream resulting from their union, here called the "Sebago River," flowed southward through the valley now occupied by Crooked River, through the basin of Sebago Lake and into the ocean near Old Orchard.

East of the Sebago system was a north-south stream which with its tributaries, including the Little Androscoggin, drained nearly all the region between the Sebago and Kennebec rivers.

East of Bethel the drainage lines were greatly disarranged by heavy deposits of glacial drift. A single stream may occupy portions of several preglacial valleys and have other portions of its course of postglacial origin.

The capture of the Mahoosuc River by the Sebago River is probably not due to glacial disarrangement, but is best explained as preglacial piracy by the Sebago River.

The economic effects of these drainage changes are very important. The falls at Berlin and Gorham are due to piracy; and the pirate stream has not yet eroded the valley to grade. The falls at Rumford, Livermore, Lewiston, Lisbon, and Brunswick are due to the displacement of the river by glacial deposits. These falls furnish a large amount of valuable water power and there are important mills at all the places named. Prior to the rearrangement of the drainage there was probably little if any potential water power. When the pirate stream cut through the divide it made an easy route through the mountains which is now occupied by a railroad.